Pool

What do you think about as you are playing pool? You probably are not thinking about this law of physics: every object continues in its state of rest, or of uniform motion in a straight line, unless it is compelled to change that state by forces impressed upon it. Gee, I thought pool was just bumping one ball into another until one goes into the pocket. Pool is actually both physics and fun. Physics is an intricate part of the game of pool. Even little things mean a lot. The action of chalking the cue stick changes the physics of pool. The material that covers the tabletop also enhances the physical properties of the balls. So get ready in this section to improve your game by learning the physics of pool. We will examine:

- What determines what the ball will do?
- What types of collisions are involved in pool?
- What can spin do for your game?
- What can angles do for your game?
- What does friction have to do with pool?

Question 1: What determines what the ball will do?

Introduction

The action of the ball is dependent on several factors: the force that initiates the ball's movement, the spin of the cue ball hitting the object ball, where the cue ball hits the object ball, and the speed and magnitude of both balls. In this experiment, we will try to determine if these factors are relevant and if there are any others.

Equipment Needed

Pool table, sticks, chalk and balls

Procedure

In teams, the class is going to play some pool. Teams should consist of good players and poor players. It is important that everyone have a chance to try to play. As one student shoots, the other students should be watching what the ball does and how the cue ball and object balls affect each other.

Analysis/Questions

1. What do you feel are the two most important factors involved in moving the object ball? Why do you feel this way?
2. What do you feel is the least important factor? Why is this not as important?

3. State one factor involved in playing pool for each of Newton's three laws of motion.
4. How can you use what you learned here to improve your pool game?

Question 2: What types of collisions are involved in pool?

Introduction

There are two types of collisions in our world. Elastic collision are when objects collide without either being permanently deformed and without heat. Inelastic collisions are objects colliding and heat is created and the objects are deformed or tangled. Collisions in pool also have to do with the conservation of momentum. The net momentum before the collision has to equal the net momentum after the collision. As two balls hit one another they become a system in physics and they transfer, if possible, their momentum to one another. In this lab we will create several examples and try to determine the outcome.

Equipment Needed

Pool table, sticks, chalk and balls

Procedure

Each team will set up different ball situations, and then see what happens when the balls collide. You should do at least seven different ball situations. For each one, draw an initial diagram with velocity arrows and a final diagram once the balls are hit, again with velocity arrows.

Analysis/Questions

1. Are collisions in pool elastic or inelastic?
2. Name two situations where you could not predict what was going to happen. Why did those seem to not fit?
3. How do you know that momentum is being conserved?
4. How can you use what you learned here to improve your pool game?

Question 3: What can spin do for your game?

Introduction

In this experiment we are going to determine how spin affects the game of pool. There are several different types of spin: no spin, backspin (draw), frontspin (follow), side spin (both Left and Right English). Pool is affected by the spin on both the cue ball and the object ball.

Equipment Needed

Pool table, sticks, chalk and balls

Procedure

The first part of the lab will to determine how to impart spin (any type) onto a ball. The next part of the lab will be determining what happens when the cue ball has spin, and it hits the object ball in a certain spot.
These are the situations:

1. Topspin on a cue ball hits the object ball center.
2. Backspin on a cue ball hits the object ball center.
3. Left English on a cue ball hits the object ball center.
4. No spin on the cue ball hits the left side of the object ball.
5. Right English cue ball hits the left side of the object ball.
6. Backspin on the cue ball hits the right side of the object ball.

Analysis/Questions

1. Why is backspin called draw and topspin called follow?
2. Pick three situations, draw the beginning diagram and the final diagram describing the paths taken and the approximate angles taken.
3. How can you use what you have learned here to improve your pool game?

Question 4: What can angles do for your game?

Introduction

Pool cannot be played without angles. Angles are what helps the trick shooters astound the audience. When you add the spin factors in the game of pool with the angles involved, life becomes more complex. When the ball is hit into the rail at an angle α with no spin, the ball will leave the rail at angle β. Angle α is called the angle of incidence and angle β is called the angle of reflection. When the ball is hit with no spin, angle α = angle β. In this lab, you will see what happens with spins involved.

Equipment Needed

Pool table, sticks, chalk and balls

Procedure

You are going to hit the ball into the rail at a particular angle with each of the spins indicated in the table below. It might help to draw a diagram.

Spin	Angle hit into rail	Spin off rail	Angle off rail
No spin			
Left English			
Right English			
Draw			

Follow

Analysis/Questions

1. Did you expect the results you got? Give one example you did not expect and tell what you thought should happen.
2. Are the angles in and out always the same? Why or why not?
3. Why do you think the angle out is called the angle of reflection?
4. How can what you learned help to improve you pool game?

Question 5:

What does friction have to do with pool?

Introduction

Friction, our little buddy that helps us walk down the sidewalk without falling on our…. But what does friction have to do with pool. The game of pool could not be played without friction; the tabletop and the bumping of the balls, all has to do with friction. The magnitude of friction always has to do with three factors: the masses of the objects involved, the surfaces involved in contact, and if there are any lubricants involved. Let's see what these factors do to the game of pool.

Equipment Needed

Pool table, sticks, chalk and balls

Procedure

Part I:

You are going to hit some balls around without chalking the cue stick. What happens?

Part II:

You are going to hit some balls on different tabletop materials. The original tabletop material is composed of a wool mixture. You are going to try several other materials to see what happens. These materials are silk, burlap, polyester fill, and cotton. What happens?

Analysis/Questions

1. What does the chalk have to do with friction? Does it increase or decrease friction?
2. What does the tabletop material have to do with friction? Does it increase or decrease friction?
3. What is the worst material you found for playing pool?
4. How can what you learned here improve you pool game?